DOCUMENT RESUME

ED 194 446 SP 015 217

AUTHOR Pieron, Maurice
TITLE Process Analysis of Teaching Physical Education.
PUB DATE Oct 79
NOTE 11p.: Paper presented at the International Conference on "Physical Education and Sport for Children and Youth" (Warsaw, Poland, October, 1979).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Academic Achievement: *Classroom Environment: Classroom Techniques: Elementary Secondary Education: Feedback: Physical Education: Student Behavior: Student Teacher Relationship: *Teacher Behavior: *Teacher Characteristics: Teacher Education: *Teacher Influence: *Teaching Skills

ABSTRACT

In studies dealing with classroom environment, functions and meanings of teacher interventions, and student behavior, several variables reflect teacher effectiveness. Presage variables concern the characteristics of the teacher; product variables concern the outcomes of teaching: and process variables concern the activities of teaching. Studies based on presage or product variables provide a very limited amount of knowledge usable in the teaching practice. The research focus has been shifted to process variables to better understand teaching. A model associating presage, process, and product variables aids understanding of the teaching process and facilitates a summarization of research on effective teacher behavior: (1) Descriptive studies of teaching physical education identify and clarify many teacher interventions: (2) Interventions that increase teaching effectiveness include reduction of negative interventions, increase of feedback and positive reinforcement, and creation of a more confident classroom environment: (3) Research should examine the relationships among teacher interventions, classroom management techniques, and student achievement: and (4) Defining an array of competencies for effective teacher behaviors will improve teacher education. (CJ)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Maurice Pieron

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ED194446

AIESEP

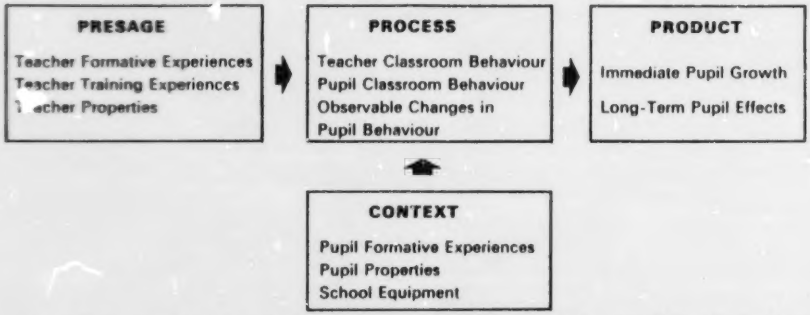
CHRONICLE

PROCESS ANALYSIS OF TEACHING PHYSICAL EDUCATION*

by

Maurice Pieron
University of Liege

A paradigm designed by Mitzel aids understanding of the teaching process and enables us to summarize research knowledge. Many theorists of education have modified, refined and used this paradigm. The model associates presage, context, process and product variables. These are well defined in educational textbooks (G. Dussault & coll., 1973; M. Dunkin & B. Biddle, 1974).



Presage variables concern the characteristics of the teacher: formative and training experiences, personality, properties. Context variables concern the teaching environment: material and equipment and formative experiences of the pupils. Process variables concern the activities, what happens in the classroom, in the sports hall, on the sports field. Product variables concern the outcomes of teaching.

Studies based on presage or product variables provide a very limited amount of knowledge usable in teaching practice. The research focus had to be shifted to process, to what was happening in the classroom, to better understand teaching. Some years ago, this research trend appeared in physical education.

* Address given at the International Conference on 'Physical Education and Sport for Children and Youth', Warsaw, Poland, October 1979.

SP 015 217

Teaching analysis attempts to describe accurately and objectively the reality of a class. It is based on observation of teachers' and students' behaviours through systems of categories.

After validating the observation system and training the observers to gather reliable data, these schedules are applied in live observation or in observation of videotapes. When used for research purposes some multidimensional systems need a written transcript of teacher and student talk.

Observation systems found application as controllers of teaching strategies, as feedback in teacher training, as research instruments identifying various kinds of teacher behaviours or interaction patterns.

As pointed out by Anderson (1971) the principal concern of descriptive-analytic studies is "to collect accurate descriptive records of events in actual classrooms and to analyse these records in a way that enables a better understanding of the events."

If limited to the sole descriptive aspect, teaching analysis would soon become a sterile academic exercise unable to fulfil the hopes it raises: to improve teaching.

In this paper, we shall seek out several variables reflecting efficient teaching in studies dealing with the climate of the class, functions and meanings of teacher interventions, and students' behaviours. In evaluating teaching, data collected in the "Beginning Teacher Evaluation Study" and in the "Research on Teaching Effectiveness" trends prove to be of interest as an inspiration source for physical education.

Observation of Teachers' Behaviours

1. Climate of the class

The origins of Flanders Observation Interaction System in the studies on the climate of classroom are well known. Teacher and student verbal behaviours are observed, classified in 10 categories, entered into an interaction matrix.

The teacher talk contributes creating the social climate of the class through: (1) an indirect influence by praising, accepting suggestions and feelings by the students, asking questions; (2) a direct influence through lecture, direction and justification of authority.

The indirect influence fits the commitment of many education theorists seeing a better means to prepare students to become active and responsible adults in a changing society. Let us keep out associating necessarily indirect influence with quality or effectiveness of teaching.

Some situations need an indirect influence, others benefit more from direct intervention.

Descriptive studies having used the F.I.A.S., (G. Nygaard, 1971, 1978) or a modified F.I.A.S. (N. Dougherty, 1970; J. Cheffers, 1972, 1974; M. Piéron & C Drion, 1977; J. Cheffers and V. Mancini, 1978) have provided data worthy of being examined when considering teaching effectiveness.

(1) Direct influence prevailed overwhelmingly (G. Nygaard, 1971; M. Pieron and C. Drion, 1977; J. Cheffers and V. Mancini, 1978). Teaching styles like command teaching, task teaching or teaching individual programmes differed in indirect/direct ratio, amount of extended direct influence (N. Dougherty, 1970).

J. Brunelle (1973) confirmed this predominant direct influence with the Joyce observation schedule: direct approach, 92% — indirect approach, 8% in student-teachers.

(2) Primary interaction patterns were quite similar in most teachers.
Silence and/or confusion — lecture — silence and/or confusion (G. Nygaard, 1971).
Activity — lecture — demonstration — directions — activity (M. Piéron and C. Drion, 1977).
Extended teacher information giving and demonstration — narrow student response — teacher information giving — extended teacher direction — narrow student response (J. Cheffers and V. Mancini, 1978).
Fortunately individual differences are reported. An experienced teacher, analysed 9 times showed more flexibility than a sample of ten student-teachers (M. Demarteau and M. Piéron, 1978). The ever changing physical education situation stems from a more flexible approach which does not appear in most of the teachers.
Secondary interactions patterns seemed to be more discriminative between teaching approaches and strategies.

(3) Significant differences between variables reflecting the climate of the class according to sex and teaching grade level were scarce (J. Cheffers, 1977; J. Cheffers and V. Mancini, 1978). J. Cheffers and V. Mancini (1978) put some doubts on the opportunity and adequacy of separate teacher training according to teaching level.
Context variables such as subject matter taught or class organization exert a stronger influence on teacher-student interaction than teachers' gender (M. Piéron, 1978).

(4) Discrepancies occurred in a category labelled silence and/or confusion in the F.I.A.S. This category represents periods when no talk between teacher and students happened, but students may take part in active game playing, exercising, practising, interacting between them or do nothing.
This category amounted to approximately 10% of the tallies in Nygaard's study, and to 30% in N. Dougherty and M. Piéron and C. Drion's data. What is the teacher doing during that time? At best, he assists, demonstrates, observes silently. The 40 teachers analyzed by W. Anderson and G. Barrette (1978) were observing 21·1% of the class time. The author is wondering what part they are taking in students' learning?

2. Teachers' interventions

A profile of teachers' interventions can be drawn from observation schedule simply in ranking them by order.
Educational theories, researcher concerns, different views on teaching stimulate the choice or the construction of observation systems. It is hard to shift from one system to another, to compare data dealing with categories labelled in the same way but covering different concepts. This comparison is only possible after carefully considering operational definitions of behaviours.
Nevertheless, a teacher behaviour profile arises with enough accuracy to be used in teacher training or in in-service training. Some teaching functions are predominantly employed in the interaction. When intervening, a teacher organizes, informs, gives the learner some feedback; he exerts affectivity functions towards the student. All these interventions are not equal in importance from an educational standpoint.

(a) organization (managerial) functions

These interventions group statements dealing with providing equipment, discipline, behaviour conduct of the class, the pace of exercises imposed by

teacher, commands at the start and the end of an activity. They do not concern the content or subject matter taught.

A high level of managerial behaviours seems to be a characteristic of teaching physical activities. They often account for more than 20% of the total of teaching verbal events (M. Demarteau and M. Piéron, 1978; M. Piéron and J. Hacourt, 1979).

M. Stewart (1977), W. Anderson and G. Barrette (1978) confirmed this quantitative importance of the managerial function. J. Quarterman (1978) observed that 34% of class time was spent in organization.

The managerial behaviours reflect a praiseworthy concern to provide students with the best possible conditions to practice a skill and to repeat it as many times as possible. They are prerequisite conditions to efficient learning. However, these behaviours do not produce a direct educational effect on the learner.

Authors agree that decreasing this amount of managerial intervention gains as much for the students as for the quality of the interaction (D. Siedentop, 1976; J. Brunelle, 1979; M. Piéron and J. Hacourt, 1979).

Studies directed by D. Siedentop aiming at teachers' behaviours modification, show that frequency of organizational events and amount of time spent in management can be markedly reduced (C. Hughley, 1973; F. Rife, 1973; J. Boehm, 1974; J. Currens, 1977; C. Cramer, 1977).

Besides providing helpful conditions for learning and practice, organization functions must attempt to gain and maintain an active participation of the greatest number of students in a class. Positive affective teacher interventions fulfil some of these aims to benefit students' growth and development.

(b) Content interventions

Usually observation systems account for subject matter only through global and rather inaccurate categories. Observation schedules derived from F.I.A.S. consider the teacher lecturing, asking questions and utilizing students' suggestions and ideas. W. Anderson and G. Barrette set apart preparatory instruction (1·42% of class time), and concurrent instruction (17·1% of class time), M. Piéron and J. Hacourt (1979) classify these interventions in a content category (20 to 22%), and in development and (9 — 10%) categories dealing more with the students' contribution.

Research data showed that teachers asked few questions regarding the cognitive content of physical activities. Knowledge of teacher-student interaction, does not allow the selection of variables reflecting the students' growth or teaching effectiveness in content categories.

(c) Functions of feedback

Knowledge of results favours performance. It is a requisite condition to improve it. Some abilities include clues of self-evaluation, others are harder to estimate by the student. The teacher's ability to provide evaluation clues differ considerably. Sometimes, he wishes to complete intrinsic information or provide hints inaccessible to the student. The student rarely realizes at the first attempt the performance expected by the teacher. The latter issues information intending to change, to correct successive student trials.

Definition of feedback used by S. Fishman and W. Anderson (1971) fits our aims: "a teaching behaviour dependent upon the motor response of one or more students and intended to provide information related to the acquisition or performance of a motor skill".

Several observation schedules devote a category to feedback. Quantitative

importance of feedback in teacher-student interaction appeared clearly in most studies. Using the observational system for the analysis of classroom interaction (Hough), M. Piéron and C. Drion (1977) observed that feedback accounted for 7·3% of the total amount of tallies and 9·0% of recorded events. It amounted to 17·3% of verbal interventions of the same teacher observed nine times; the variation ranged from 10·2 to 21·8% (M. Demarteau and M. Piéron, 1978).

In analyzing ice hockey instructors, J. Brunelle and coll. (1978) registered 23·53% of feedback. The analysis unit being the verbal event.

The optimistic view gained in considering some high proportions of feedback in the total amount of teacher intervention must be moderated.

Students observed by S. Fishman and C. Tobey (1978) issued barely more than one feedback every minute. However, a female teacher observed several times, issued a feedback every eleven seconds and student teachers one feedback every 18 seconds (M. Piéron and C. Devillers, 1978).

Feedback is predominantly single student oriented: 77% (S. Fishman and C. Tobey, 1978), 71·7% and 79·7% (M. Piéron and C. Devillers, 1978) of feedbacks were directed towards a single pupil. With some classes above 30 students, the author is wondering at what rate a student will be personally involved, receiving clues dealing with his performance.

Feedback may stand as central element of teacher-student interaction. S. Fishman and W. Anderson (1971), W. Harrington (1974), S. Fishman (1974), C. Tobey (1974), S. Fishman and C. Tobey (1978), M. Piéron and C. Devillers (1978) devised or/and used multidimensional analysis describing mostly form, content, intent, general and specific referents and direction of feedback.

Large differences appeared in the structure of feedback. Approximately one fourth of total amount of feedback took an evaluative aspect by which teacher evaluates and confirms the learner's performance through a positive or negative sentence, but avoided providing some specific information related to the performance (M. Piéron, 1979). It seemed that the teacher intended to rate the performance rather than to look for some behaviour changes by reinforcement technique. Fifty-three per cent of feedback were evaluative in the S. Fishman and C. Tobey study (1978).

Besides the evaluative aspect of feedback, the teacher chose to give information in which one aspect of each dimension prevailed largely: feedback was verbal, an emphasis was on the cognitive aspect of content, a prescriptive intent was pursued, it was single student directed (M. Piéron, 1979).

In teachers from the video data bank project, feedback was auditory (95·2%) directed towards one student (77·3%), evaluative; it referred to the whole movement and to its spatial characteristics (85·1%), and finally predominantly negative (56·1%). Only the time of occurrence was equally distributed: concurrent of movement (48·8%) and terminal (48·7%) (S. Fishman and C. Tobey, 1978). All these data reflected a stereotyped intervention.

As far as feedback is concerned, a crucial question challenges the teacher: does the feedback fulfil its aims to change the student behaviour? We have associated different feedback dimensions to observe students' changes of behaviour, in a physical education setting.

After eliminating the purely evaluative dimension, 51·3% (live observation)

and 42·6% (videotape analysis) of feedback were accompanied by a short-term change in learner's performance.

It happened that ratio of observed students' behaviour changes significantly differed according to the character of feedback. For example, an auditory-visual feedback induced more changes than a purely auditory feedback, only non significant and inconclusive changes occurred when content and direction of feedback were considered (M. Piéron, 1979).

Too often, the amount of negative feedback exceeded positive evaluations (S. Fishman and C. Tobey, 1978; M. Piéron and J. Hacourt, 1979). Most positive evaluations were provided without any further comment. Many teachers justified their negative feedback by a specific information allowing the student to be more aware of his errors.

The teacher's ability to provide the student with feedback could be variable accounting for differences the teacher can produce. Feedback is supposed to be one of the teaching skills able to raise the effectiveness of teaching. J. Brunelle (1979) considered that it is badly mastered by teachers.

The author suggests to put forward some objectives: to provide more feedback, to seek out tasks including an intrinsic feedback, to better balance group or class feedback and individual feedback, to emphasize the positive aspects of students' performance.

Students' behaviours

The importance of communication in transmitting knowledge plainly justifies the analysis of verbal interaction in a class, even in physical education. Nevertheless, one cannot guess student gains in relying only on teacher interventions or on verbal events and interactions.

Teaching will reach some effectiveness criterion only when students fulfil teaching objectives, master the skills previously practised, reach social, moral and motor objectives of physical education. An ideal would be that teaching product would reflect these concepts. Inadequacy of tests and measurements in accounting for learning gains scarcely allows Process-Product types of studies. Some proxy for product variables are searched for in students' behaviours.

Studies realized in the "Beginning Teaching Evaluation Study" (BTES) pointed out positive relationships between learning gains and time spent on a task by students (B. Bennett, 1978; B. Rosenshine, 1978). It is hazardous to transfer knowledge concerning learning of reading or elementary maths to physical education. However these results are an inspiring source of thinking for physical educators.

Systematic student observation remains still rare in physical education teaching. Few observation systems are available. In this domain, the Teachers College video data bank constitutes an extremely valuable source of information too.

1. Student activity time

This variable is supposed to play a prominent role in student learning and in student adaptation to effort.

Students of elementary level classes took part in motor activities during 29·9% of class time (practice 15·3%, game playing 10·3%, exercise 3·6%, movement exploration 2%, expression-communication 5%) (J. Costello and S. Laubach, 1978). Results are quite similar in secondary level classes: 29·9% (M. Piéron and J. M. Haan, 1979). Student teachers obtained from their pupils less activity time: 24% (M. Piéron and A. Dohogne).

Large and significant differences occurred according to skill practiced: gymnastics, track and field or team sports.

Although pretty rough, this variable gives a first estimate of teaching effectiveness. It is usable in supervision. Some comparison standards are in great need. This variable must be refined like in ALT-PE project (D. Siedentop). Academic Learning Time (ALT) is "time spent by a student engaged on a task on which few errors are produced, and where the task is directly relevant to an academic outcome" (Fisher C. N. and coll., 1977). A major finding of BTES is that ALT is positively related with student learning gains.

As much as activity time or time-on-task, the number of practice trials plays a striking role in learning and mastering a skill.

2. Time spent in position and managerial episodes

B. Bennett (1978) reported that "in well-organized classrooms, transitions lasted only a short time and the children seemed to transfer to another activity automatically. In contrast, transitional periods in less-organized classrooms tended to be chaotic, with children wandering about, bumping into one another, confused and needing to ask the teacher what to do". J. Brunelle (1979) selected this variable amongst 14 criteria examined in relation to teaching effectiveness. The variable was considered badly practised by teachers.

In elementary level classes, pupils spent 4·1% of class time for position, 3·4% in setting up, maintaining, dismantling and returning materials or equipment (J. Costello and S. Laubach, 1978). 5·8% of class time to managerial tasks had approximately the same meaning in M. Piéron and J. M. Haan's study.

Pupils taught by student-teacher spent 11·5% of their class time in non-substantive movement and 2·0% in dealing with equipment or materials (M. Piéron and A. Dohogne).

The differences occurring between experienced and beginning teachers tended to confirm the discriminative power of this variable. It will be advisable to decrease this amount of time involving no direct relationship with objectives of a physical education lesson.

3. Non-productive time

Some behaviours considered as non-productive lasted a large amount of class time: 35·4% awaiting (J. Costello and S. Laubach, 1978), 32·1% awaiting and inactivity (M. Piéron and J. M. Haan, 1979). 26% awaiting (M. Piéron and A. Dohogne, 1979), 6·8% inappropriate or undetermined interactions (M. Piéron and J. M. Haan, 1979). Four and a half per cent of time was spent in off-task behaviours and some part of 10·1% verbal interactions between pupils can be also viewed as non-productive.

More than teacher behaviour, student observation variables have meaning in pursuing physical education objectives: activity time, number of trials on a skill, time-on-task, non productive time, off-task behaviours.

In a recent paper, Walker (1976) pointed out that "the next decade will see as much attention to what students do in classrooms as has been paid in the past decade to what teachers do". That seems to be true in physical education too.

Changing Teachers' behaviours

Descriptive studies of teaching emphasized several teachers' behaviours

that seemed unable to produce a desirable influence on students either by the climate they create or because they cannot induce learning gain.

Some of these behaviours can be changed. We hope that some can be extinguished.

Occasionally, teaching analysis was used as an independent variable. Keilty (1975) utilized C.A.F.I.A.S. as an independent variable to study the effect exerted on student-teachers' attitudes toward teaching and on perception the learners got from teachers' influence. This study intended to check if these student-teachers would use a more indirect approach after their training. The perception of teachers' influence differed significantly between experimental and control groups. Student teachers from the experimental group were perceived as more pupil accepting and more direct.

Some training programmes, or intervention packages including instructions on the nature of behaviour categories, graphic feedback, cueing and reinforcement, modelling, and goal setting, changed some teaching specific behaviours: rates of managerial interventions, of negative reactions to students' behaviours, of negative feedbacks sharply decreased. Positive feedback, positive reactions to student behaviours became more frequent (C. Hughley, 1973; F. Rife, 1973; J. Boehm, 1974). The multiple baseline was used to compare behaviour rates during baseline and intervention.

Percentage of students actively engaged in learning increased (P. Darst, 1974). Most striking changes occurred in managerial interventions, active time, negative interactions, corrective feedback and students appropriate behaviours (J. Currens, 1977; C. Cramer, 1977).

Conclusions

(1) Descriptive studies of teaching physical education identified, clarified many teachers' interventions; they specified the nature of verbal interactions occurring in class.

(2) Some knowledges of human behaviour, data from academic teaching and intensive reflection on supervision allow to infer the suitability of some interventions, to propose a more frequent use of some events if one wishes to increase teaching effectiveness: decrease negative intervention rate, provide students with more feedback and more positive reinforcement, create a more confident climate in the classroom and decrease managerial time.

(3) It seems logical to seek out the relationships between teacher interventions and his conduct of the class with learning gains of the pupils, or with some substitute variables of product such as time-on-task, ALT, non productive time, number of trials in a skill and inappropriate behaviours.

(4) Looking for an array of competencies and of effective teaching behaviours will improve teacher training. Their identification, their comparison in more effective and less effective teachers provides an important challenge for methodologists of physical education.

References

1. ANDERSON, W. G. 'Descriptive-analytic research on teaching. *Quest*, 15, 1971, pp. 1-8.
2. ANDERSON, W. G. and BARRETTE, G. 'What's going on in gym: descriptive studies of physical education classes'. *Monograph 1, Motor skills: Theory into practice*, 1978.
3. ANDERSON, W. G. and BARRETTE, G. 'Teacher behaviour'. In Anderson, W. G. and Barrette, G. (Ed.), 'What's going on in gym: descriptive studies of physical education classes. *Monograph 1, Motor skills: Theory into practice*, 1978, pp. 25-38.

4. BENNETT, N. 'Recent research on teaching: a dream, a belief, and a model'. *Journal of Education* (Boston), 160, 3, 1978, pp. 5-37.
5. BOEHM, J. H. 'The effects of a competency-based teaching programme on junior high school physical education student teachers and their pupils', Ph.D., Ohio St. Univ., 1974.
6. BRUNELLE, J. 'Utilisation du système de Joyce dans la formation des stagiaires (education physique)', in Dussault, G. et Coll. *L'analyse de l'enseignement*, Montréal, Presses Univ. Quebec, 1973, pp. 261-280.
7. BRUNELLE, J. 'Comment les instructeurs de hockey enseignent. Rapport de recherche sur l'analyse des stratégies d'enseignement des instructeurs de hockey', Quebec, Univ. Laval, 1976.
8. BRUNELLE J. 'Description de l'enseignement en éducation physique. Document de travail', 1979, N.P.
9. CHEFFERS, J. T. F. 'The validation of an instrument designed to expand the Flanders system of interaction analysis to describe non-verbal interaction, different varieties of teacher behaviour and pupil responses'. Ed. D., Temple Univ., 1973.
10. CHEFFERS, J. T. F., AMIDON, E. J. and RODGERS, K. D. 'Interaction analysis: an application to non-verbal activity', Minneapolis, assn. for productive teaching, 1974.
11. CHEFFERS, J. T. F. and MANCINI, V. H. 'Teacher-student interaction' in Anderson, W. G. and Barrette, G. T., 'What's going on in gym: descriptive studies of physical education classes', *Monograph 1, Motor skills: Theory into practice*, 1978, pp. 39-50.
12. COSTELLO, J. and LAUBACH, S. A. 'Student Behaviour'. In Anderson, W. G. and Barrette G. (Ed.), 'What's going on in gym: descriptive studies of physical education classes'. *Monograph 1, Motor skills: Theory into practice*, 1978, pp. 11-24.
13. CRAMER, C. A. 'The effects of a co-operating teacher training programme in applied behaviour analysis on selected teacher behaviours of secondary physical education student teachers', Ph.D., Ohio. St. Univ., 1977.
14. CURRENS, J. W. 'An applied behaviour analysis training model for preservice teachers', Ph.D., Ohio State Univ., 1977.
15. DARST, P. W. 'The effects of a competency-based intervention on student teacher and pupil behaviour', Ph.D., Ohio St. Univ., 1974.
16. DEMARTEAU, M. and PIÉRON, M. 'Analyse des communications verbales entre un professeur d'éducation physique et ses élèves. In PIÉRON, M. (Ed), *Towards a science of teaching physical education: teaching analysis*, Liège, A.I.E.S.E.P., 1978, pp. 98-124.
17. DOUGHERTY, N. J. 'A comparison of the effects of command, task and individual programme styles of teaching in the development of physical fitness and motor skills', Ed. D., Temple Univ., 1970.
18. DUNKIN, M. J. and BIDDLE, B. J. *The Study of Teaching*. New York, Holt, Rinehart and Winston, 1974.
19. DUSSAULT, G. et coll. *L'analyse de l'enseignement*, Montréal, Presses Univ. Quebec, 1973.
20. FISHMAN, S. E. and ANDERSON, W. G. 'Developing a system for describing teaching', *Quest* 15, 1971, pp. 9-16.
21. FISHMAN, S. E. 'A procedure for recording augmented feedback in physical education classes', Ed. D., Columbia Univ., New York, 1974.
22. FISHMAN, S. and TOBEY, C. 'Augmented feedback', in ANDERSON, W. G. and BARRETTE, G. T., 'What's going on in gym: Descriptive studies of physical education classes'. *Monograph 1, Motor skills: Theory into practice*, 1978, pp. 51-62.
23. HARRINGTON, W. M. 'A study of feedback diversity in teaching physical education', Ph.D., Univ. Wisconsin, 1974.
24. HUGHLEY, C. 'Modification of teaching behaviours in physical education', Ph.D., Ohio State Univ., 1973.
25. KEILTY, G. 'The effect of instruction and supervision in interaction analysis on the preparation of student teachers,' Ed. D., Boston Univ., 1975.
26. LAUBACH, S. A. 'The development of a system for coding student behaviour in physical classes', Ed. D., Columbia Univ., New York, 1975.
27. MITZEL, H. E. 'Teacher effectiveness', in C. W. HARRIS (Ed), *Encyclopedia of Educational Research* (3rd Ed.), New York, Macmillan, 1960.
28. NYGAARD, G. A. 'An analysis of verbal interaction in physical education classes', Ed. D., Univ. Oregon, 1971.
29. PIÉRON, M. 'Didactique et méthodologie des activités physiques', Liège, Univ. Liège, 1976.
30. PIÉRON, M. and DRION, C. 'Analyse de l'interaction entre le professeur et ses élèves en education physique, par le système de Hough', *Rev. Educ. Phys.*, 17, 1977, pp. 27-37.
31. PIÉRON, M. 'Pédagogie renovée des activités physiques', in LANDRY, F. and ORBAN, W. A. R., 'International congress of physical activity sciences', 7. *Motor learning, Sport psychology, Pedagogy and didactics of physical activity*, Miami, Symposia specialists, 1978, pp. 383-391.

32. PIÉRON, M. and HACOURT, J. 'Teaching behaviours at different levels of physical education teaching', *FIEP Bulletin*, vol. 49, 1979.
33. PIÉRON, M. 'Variation du comportement verbal d'enseignants selon la spécialité sportive enseignée', in LANDRY, F. and ORBAN, W. A. R., 'International congress of physical activity sciences', *7. Motor learning, Sport psychology, Pedagogy and didactics of physical activity*, Miami, Symposia specialists, 1978, pp. 443-449.
34. PIÉRON, M. and DEVILLERS, C. 'Multidimensional analysis of infórmative feedback in teaching physical activities', Paper delivered at the A.I.E.S.E.P. International Conference, Magglingen, 1978.
35. PIÉRON, M. and HAAN, J. M. 'Interactions between teacher and students in a physical education setting. Observation of students behaviours'. Paper delivered at the ICHPER Congress, Kiel, 1979.
36. QUARTERMAN, J. 'A descriptive analysis of teaching physical education in the elementary schools'. Ph.D., Ohio St. Univ., 1978.
37. RIFE, F. N. 'Modification of student-teacher behaviour and its effects upon pupil behaviour', Ph.D., Ohio St. Univ., 1973.
38. ROSENSHINE, B. V. 'Academic engaged time, content covered, and direct instruction', *Journal of Education* (Boston), 160, 3, 1978, pp. 38-66.
39. SIEDENTOP, D. *Developing teaching skills in physical education*, Boston, Houghton Mifflin Cy., 1976.
40. SIEDENTOP, D. BIRDELL, D. and METZLER, M. 'A process approach to measuring teaching effectiveness in physical education', Summary of papers read at the AAHPER Research Symposium, New Orleans, March 1979.
41. STEWART, M. J. 'A descriptive analysis of teaching behaviour and its relationships to presage and context variables', Ph.D., Ohio St. Univ., 1977.
42. TOBEY, C. 'A descriptive analysis of the occurrence of augmented feedback in physical education classes', Ed. D., Columbia Univ., New York, 1974.
43. WALKER, D. F. 'Toward comprehension of curriculum realities.' In L. S. Shulman (Ed.), *Review of Research in Education* 4, Itasca, F. E. Peacock, 1976 (cited by Bennett).